- **The Impact of Oil and Gas Rent on Promoting Economic Growth in Algeria**

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Abstract

This study examines the impact of oil and gas rent on promoting economic growth in Algeria over the period (1980-2010) using Engle-Granger cointegration test and error correction model , findings indicate that both oil and gas rent have a positive impact on enhacing economic growth in Algeria in the long term , error correction model confirms the existence of positive relationship between variables in the long and short term for two models. These results emphasize the great dependece of Algerian economic growth on oil and gaz rent.Thus, Algerian government must carefully lead the process of allocating and monitoring the use of oil and gas revenue and turning it into positive economic growth. Furthermore, policymakers should care more about economic activities diversification in order to reduce the dependence on oil and gas sector, as well as rent seeking activities, especially with the appearance of alternative forms of energy (such as wind, water, and solar power).

Key words : Oil Rent, Gas Rent, Economic Growth, Algeria, Cointegration test.

ملخص

تختبر هذه الدراسة اثر ريع النفط و الغاز على تعزيز النمو الاقتصادي في الجزائر خلال الفترة (1980-2010) باستخدام اختبار التكامل المتزامن ل Engle-Granger و نموذج تصحيح الخطأ ، تشير النتائج إلى أن كل من ريع الغاز و النفط له اثر ايجابي على تعظيم النمو الاقتصادي في الجزائر على المدى الطويل ، كما يؤكد نموذج تصحيح الخطأ وجود علاقة ايجابية مابين المتغيرات في المدى الطويل و القصير للنموذجين، وتؤكد هذه النتائج الاعتماد الكبير للنمو الاقتصادي الجزائري على ريع النفط و الغاز ، و بالتالي يجب على الحكومة الجزائرية أن تقود بحذر عملية تخصيص و مراقبة استعمال مدخول النفط و الغاز و تسخيره نحو نمو اقتصادي ايجابي ، أيضا ينبغي على صناع القرار الاهتمام أكثر بتنويع النشاطات الاقتصادية من اجل تقليل الاعتماد على قطاع النفط و الغاز و كذا نشاطات السعي الريعي ، خاصة مع ظهور أشكال بديلة للطاقة(كالرياح، المياه، الطاقة الشمسية).

الكلمات المفتاحية : ريع النفط ، ريع الغاز، النمو الاقتصادي ، الجزائر ، اختبار التكامل المتزامن .

1. Introduction

The impact of oil and gas rent on economic growth has occupied the attention of researchers especially in last decades , both ecologists and economists have called attention to the essential dependence of economies on natural resources(James H. Brown, William R. Burnside, Ana D. Davidson, John P. DeLong, William C. Dunn, Marcus J. Hamilton, Norman Mercado-Silva, Jeffrey C. Nekola, Jordan G. Okie, William H. Woodruff, and Wenyun Zuo ,2011**),** because most of production and consumption activities rely on this natural resources energy , therefore, energy especially (oil and gas) is considered as an important source of national wealth and economic growth around the world, the prevailing view is that there is a positive impact

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of oil and gas rent on promoting economic growth . The huge revenues from oil and gas, of course, presented net wealth and thus provided opportunity for promoting economic growth through several ways for example high oil and gas rent brings increased profits , wages and helps accumulating foreign reserves, also the foreign exchange earnings from oil and gas exports can satisfy the other non oil sectors demand of intermediate goods , in particular during price booms. As well as oil and gas sector attract foreign direct investment which has good effect and positive spillovers on economic growth in the host country through bringing important production factors such as capital,hard currency, managerial skills , research and develpment**(**Juraj Stancik,2010**)** .Furthermore , MNC is considered as the most efficient source of technological spillovers**(**Lobna Ali Al-Khalifa,2010**)**.

On the other hand oil and gas exports can harm economic growth rate through driving up the real exchange rate of the currency, thus possibly reducing manufacturing and service exports **(**Corden, 1984**),** also the heavy dependence on natural resource is directly associated with corruption, inequality,and all that tend to hamper economic progress and growth **(**Thorvaldur Gylfason ,2004**)** , as well as it weakens the quality of institutions **(**Amela Karabegović , 2009**)** . Moreover, oil price increases lead to higher inflation,in other words rising oil and gas prices and falling wages diminish the purchasing power of consumers **(**Akira Yanagisawa, 2012**)**.

Algeria is one of the developing countries which is highly endowed with abundant natural resources, there is a great dependence of the algerian economy on oil and gas sector that plays a key role in rising foreign reserves and accelerating economic growth . This study aims to test the impact of oil and gas rent on promoting economic growth in Algeria over the period (1980-2010) using Engle-Granger cointegration test and error correction model ,for that purpose, the paper is organized as follows:

Section 2 presents some empirical literature, section 3 describes the data and econometric method used, then section 4 analyses the results, and finally section 5 cames as a conclusion of this study.

2. Empirical Literature Review :

The impact of oil and gas rent on economic growth has been a subject of intense debate over the past two decades, numerous studies have produced conflicting results: some of them suggest that natural resource abundance especially oil and gas rent is highly and positively correlated with economic growth, these studies are as follow :

Mohd Shahidan Shaari , Nor Ermawati Hussain and Mohammad Shariff Ismail **(**2013**)** employed Johansen cointegration test and Granger causality model for testing the relationship between energy consumptions and economic growth in Malaysia from 1980 to 2010 , Findings indicated that there is a positive long-run relationship between energy consumption and GDP , also Granger causality model showed that oil Granger cause GDP at 10% level of significance and gas consumption Granger causes GDP at 5% level of significance while there is no causality from GDP to each of oil and gas consumption. Similarly, Sarwat Razzaqi, Faiz Bilquees and Saadia Sherbaz (2011) tested the relationship between energy use and economic growth in the D8 countries from the year 1980 to 2007 using Granger causality test and Johansen cointegration test as well as VECM, it is concluded that energy use significantly causes the economic growth in energy exporters countries, also there is at least one cointegrating relationship between energy use and real GDP for all countries. Furthermore VECM proved the existence of short-run and long-run correlation between energy use and economic growth in all countries.Also, Oluwatosin Ademola Adeniyi ,Abimbola Oyinlola,Olusegun A. Omisakin(2011) in an empirical investigation of the effect of oil price shocks on economic growth using Johansen cointegration test, impulse response functions and variance decomposition by employing quarterly data spanning 1985Q1 to 2008Q4, he found that oil price shocks have a positive impact on GDP in Nigeria. As well as, Cengiz Aktaş , Veysel Yılmaz **(**2008**)** investigated the relationship and causality between oil consumption and economic growth in Turkey using Johansen cointegration test for a period of 1970-2004 , their results indicated that there are bidirectional causality between oil consumption and economic growth in the short and long run.

Moreover, Yusuf Umar Dantama, Yahya Zakari Abdullahi, Nasiru Inuwa (2012) examined the impact of energy consumption on economic growth in Nigeria over the period 1980-2010 using lag (ARDL) approach

to cointegration analysis, their analysis revealed that there is a long-run postive relationship between petroleum consumption and economic growth. C.A. Ogbokor **(**2001**)** studied the impact of oil exports on economic growth in Nigeria using the OLSQ regression technique for the period 1980 – 2000, he found that oil exports have a positive and strong effect on enhacing economic growth in Nigeria.However, supporting the positive impact of oil and gas rents on economic growth, Dustin Chambers and Jang-Ting Guo**(**2009**)** explored the interrelations between natural resources and economic growth for 93 countries over the period (1961- 2001) using standard fixed- or random-effect methods to estimate a dynamic panel model by employing Generalized Method of Moments (GMM) estimator, they found that natural resources abundance boost economic growth in the short run . In addition,Latife Ghalayini **(**2011**)** examined the impact of oil price changes on economic world growth through employing Granger causality test for the G-7 group, OPEC countries as well as Russia, China and India,using quarterly data from2000 to 2010 , the results indicated that for the oil importer countries,there is a negative relation between oil price and economic growth , while the relation is positive between the same variables in exporter countries, also there is a unidirectional causality from oil price to GDP in G-7 group. Also,Anthony Enisan Akinlo**(**2012**)** assessed the importance of oil in the development of the Nigerian economy by adopting a multivariate cointegration analysis using VAR model over the period 1960-2009, he found that oil can cause other non oil sectors to grow. Furthermore,Lykke E. Andersen and Robert Faris **(**2002**)** used a Computable General Equilibrium (CGE) model for Bolivia from 1997 in order to examine the impact of natural gas exports on economic growth , the results indicated that increasing natural gas exports have the potential for increasing wages and incomes.Gilles Carbonnier, Natascha Wagner and Fritz Brugger**(**2011**)**carried out a dynamic panel data analysis for 108 countries from 1984 to 2007for examining the dynamic relationship between resource extraction and sustainable development, they found a positive and non significant correlation between log GDP per capita and resource richness.

In contrast, others support the negative impact of both oil and gas rent on promoting economic growth for example : Jeffrey D. Sachs and Andrew M. Warner **(**1997**)** argued that there has been a negative relationship between natural resource abundance and economic growth between 1970 and 1990 by using panel data analysis for a a sample of 95 developing countries. Justifying this point of view, S. O. Oladipo **(**2012**)** studied the effect of oil sector on economic growth in Nigeria using the Ordinary Least Square (OLS) between 1990-2006, the results indicated that there is a negative relationship between oil production and GDP growth. Similarly, Thorvaldur Gylfason and Gylfi Zoega **(**2001**)** examined the impact of natural resources on economic growth through an empirical evidence from 85 countries over the period 1965 -1998 using panel data analysis, the results showed that growth varies inversely with natural resource dependence. In addition, Adiqa Kiani (2011) analyzed the impact of higher oil prices on the Pakistan's economic growth during 1990 to 2009 using Ordinary Least Square (OLS) technique and Johansen test, he found that oil prices affect the Pakistan's economic growth negatively.

3. Data and Econometric Method

This study examines the impact of oil and gas rent on promoting economic growth in Algeria over the period (1980-2010) using the following variables :

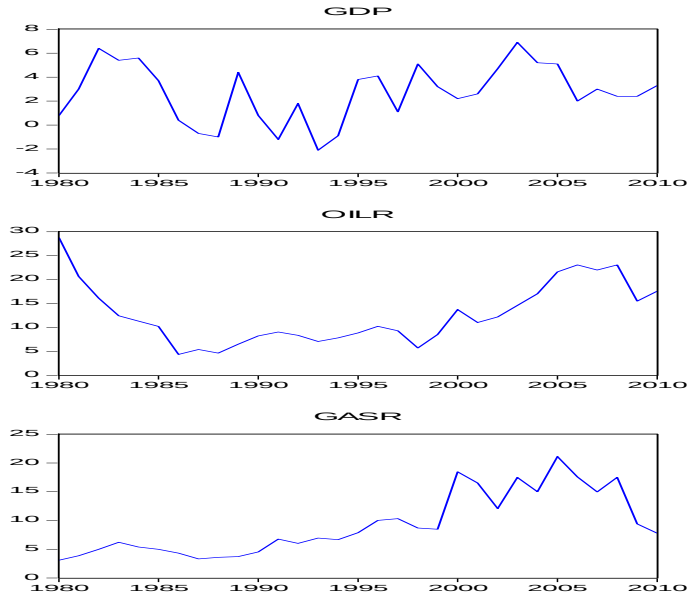
GDP : is the GDP per capita growth (annual%) from World Development Indicators representing economic growth.

OILR : is the oil rent (% of GDP) from World Development Indicators.

GASR: is the gas rent (% of GDP) from World Development Indicators.

In order to identify whether all the variables that are included in the system are cointegrated , we used the Engle-Granger cointegration test which is based on two steps ; the first is the estimation of longrun equation by using Least Squares Method and the second is unit root test of residuals , then we use the error correction model which confirms the existence of long run relationship between variables and in the same time it tests the short run dynamics using Eviews 6.0 software package.

4. Results



Analysis

The graph shows that :
GDP has fluctuated up and down , it saw a strong rise in 2003 as a result of 2001 economic programme which has been directed to promote economic and social situations in Algeria , but it has fallen sharply , this is mainly because of the oil prices decrease in 2009 under the 2008 crisis impact.

OILR has decreased sharply especially with the oil price collapse of 1986, then it has improved after this deterioration due to increased oil prices, but it saw a fall again in 2009 as a result of 2008 world crisis.

GASR has improved in comparison with its weakness in eighties and nineties althought its sharp fluctuations, but its fall in 2009 was caused by the world financial crisis.

4.1-Phillips Perron Unit Root Test

The results indicate that the null hypothesis of a unit root can not be rejected for the given variables (GDP ,OILR , GASR) and PP value is not smaller than the critical t-value at 5% level of significance for all variables, hence, we can conclude that the variables are not stationary at their levels , then again, after first differencing the following variables(GDP , OILR , GASR) , the null hypothesis of a unit root in the PP test was rejected at the 5% significance level so these variables are stationary at their first differences [they are integrated of the order one I(1)].Thus, we can proceed to the long run cointegration analysis.

	Level			**First Difference**		
	Trend & Intercept	Intercept	None	Trend & Intercept	Intercept	None
GDP	-3.249890 (0.0942)	-3.295260* (0.0241)	-1.679315 (0.0875)	-7.057129* (0.0000)	-7.233033* (0.0000)	-7.406513* (0.0000)
OILR	-4.310097* (0.0097)	-2.731322 (0.0806)	-1.648896 (0.0928)	-5.069547* (0.0016)	-4.884446* (0.0005)	-5.029691* (0.0000)

GASR	-2.390079 (0.3769)	-1.793585 (0.3763)	-0.518602 (0.4835)	-7.218031* (0.0000)	-7.015755* (0.0000)	-7.261427* (0.0000)

*indicates statistically significant at 5%.

4.2- Model 1 :The relationship between Economic Growth and Oil Rent

- **Engle-Granger cointegration two steps :**
- ***Step 1 : The estimation of longrun equation by using Least Squares Method***
  - ***Cointegrating Equation***

GDP=1.389879 +0.102185* OILR+e ***(see appendix 1).***

The positive sign of the variable (OILR) indicates its positive relationship with economic growth in the long term, a rise of 1% in oil rent causes a rise of 0.10218% in economic growth.

The P value of OILR coefficient is greater than 0.05 so it is non significant variable in explaining GDP in the long term ***(see appendix 1).***

- ***Step 2 : Unit root test of residuals***

From the results shown in the table ***(see appendix 2)***, the T statistic is less than the critical value at 5% level of significance (from Mackinnon ,1991table of critical values), so we reject the null hypothesis which indicates that there is a unit root , thus U is stationary at its level (residuals are integrated of the order zero I(0)), and this confirms the existence of one long run relationship or one cointegrating equation between economic growth and oil rent.

- **Error Correction Model :** ***(see appendix 3)***

The error correction term U(-1) has a negative sign and a P value less than 0.05 so it is negative and significant and this refers to the existence of a long run relationship between economic growth and oil rent, the ECM(u(-1)) value indicates that the speed of disequilibrium correction is 61.88% .

Oil rent coefficient D(OILR) appears with a positive value so there is a positive relationship between economic growth and oil rent in the short term , but D(OILR) is non significant in explaining GDP in short term because it has a p value greater than 0.05.

- **Diagnostic Tests of Error Correction Model :**
  - ***BREUSCH-PAGAN,GOD FREY Test :***

Prob (CHi^2)= 0.6790 that accompanies the amount (Obs*R^2) is greater than 0.05 so we accept the null hypothesis which refers that there is homoskedasticity and this is a good sign ***(see appendix 4).***

- ***BREUSCH- GOD FREY LM Test :***

Prob (CHi^2)= 0.8189 is greater than 0.05 so we accept the null hypothesis which refers that there is no serial correlation and this is a good sign ***(see appendix5).***

- ***JARQUE BERA Normality Test :***

Prob (JARQUE BERA)= 0.6671 is greater than 0.05 so we accept the null hypothesis which refers that the riesiduals are normally distributed and this is a good sign ***(see appendix 6).***

So all Diagnostic Tests indicates that the Error Correction Model is a good and an acceptable model.

4.3- Model 2 :The relationship between Economic Growth and Gas Rent

- **Engle-Granger cointegration two steps :**
- ***Step 1 : The estimation of longrun equation by using Least Squares Method***

- ***Cointegrating Equation***

GDP=1.385549 +0.140962* GASR +e ***(see appendix7)***

The positive sign of the variable (GASR) indicates that there is a positive relationship between economic growth and gas rent in the long term, a rise of 0.140962% in GDP will be achieved by a rise of 1% in GASR

The P value of GASR coefficient is less than 0.1 so it is a significant variable in explaining GDP in the long term at 10% level of significance ***(see appendix 7).***

❖ ***Step 2 : Unit root test of residuals***

From the results shown in the table***(see appendix 8)***, the T statistic is less than the critical value at 5% level of significance (from Mackinnon ,1991table of critical values), so we reject the null hypothesis which indicates that there is a unit root , thus U is stationary at its level (residuals are integrated of the order zero I(0)), and this confirms the existence of one long run relationship or one cointegrating equation between economic growth and gas rent.

➢ **Error Correction Model :** ***(see appendix 9)***

The error correction term U(-1) has a negative sign and a P value less than 0.05 so it is negative and significant and this refers to the existence of a long-run relationship between economic growth and gas rent, the ECM(u(-1)) value indicates that the speed of disequilibrium correction is 59.98 % .

Gas rent coefficient D(GAZR) appears with a positive value so there is a positive relationship between economic growth and gas rent in the short term , but D(GASR) is non significant in explaining GDP in short term because it has a p value greater than 0.05.

➢ **Diagnostic Tests of Error Correction Model :**

❖ ***BREUSCH-PAGAN,GOD FREY Test :***

Prob (CHi^2)= 0.5547 that accompanies the amount (Obs*R^2)is greater than 0.05 so we accept the null hypothesis which refers that there is homoskedasticity and this is a good sig ***(see appendix 10).***

❖ ***BREUSCH- GOD FREY LM Test :***

Prob (CHi^2)= 0.7040 is greater than 0.05 so we accept the null hypothesis which refers that there is no serial correlation and this is a good sign ***(see appendix 11).***

❖ ***JARQUE BERA Normality Test :***

Prob (JARQUE BERA)= 0.6515 is greater than 0.05 so we accept the null hypothesis which refers that the riesiduals are normally distributed and this is a good sign ***(see appendix 12).***

So all Diagnostic Tests indicates that the Error Correction Model is a good and an acceptable model.

5. Conclusion

This study examines the impact of oil and gas rent on promoting economic growth in Algeria over the period (1980-2010) using Engle-Granger cointegration test and Error Correction Model , findings indicate that there is a positive long-run relationship between (economic growth and oil rent), (economic growth and gas rent),Error Correction Model confirms the existence of positive relationship between variables in the long and short term for two models. Theses results emphasize the great dependece of Algerian economic growth on oil and gas rent.

It is recommended that Algeria must carefully lead the process of allocating and

monitoring the use of oil and gas revenues for promoting economic and social situations , therefore government should strengthen its economic institutions for best management of oil and gas rent and turning it into positive economic growth.

Furthermore, the Algerian government should care more about economic activities diversification in order to reduce the dependence on oil and gas sector , as well as rent seeking activities , especially with the appearance of alternative forms of energy (such as wind, water, and solar power) .

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Appendix 1 : *The estimation of longrun equation by using Least Squares Method betwwen GDP and OILR*

Dependent Variable: GDP
Method: Least Squares
Date: 02/19/13 Time: 10:27
Sample: 1980 2010
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OILR	0.102185	0.066892	1.527607	0.1374
C	1.389879	0.950227	1.462681	0.1543

R-squared	0.074475	Mean dependent var	2.693245
Adjusted R-squared	0.042561	S.D. dependent var	2.380157
S.E. of regression	2.328955	Akaike info criterion	4.591058
Sum squared resid	157.2970	Schwarz criterion	4.683573
Log likelihood	-69.16139	Hannan-Quinn criter.	4.621215
F-statistic	2.333584	Durbin-Watson stat	1.199915
Prob(F-statistic)	0.137445		

Appendix 2 : *Unit root test of residuals*

Null Hypothesis: U has a unit root
Exogenous: Constant
Bandwidth: 2 (Newey-West using Bartlett kernel)

		Adj. t-Stat	Prob.*
Phillips-Perron test statistic		-3.846446	0.0065
Test critical values:	1% level	-3.670170	
	5% level	-2.963972	
	10% level	-2.621007	

*MacKinnon (1996) one-sided p-values.

Level of Significance	T Statistic	Critical Value
5%	-3.846446	-3.33

Appendix 3 : *Error Correction Model*

Dependent Variable: D(GDP)
Method: Least Squares

Date: 02/19/13 Time: 10:29
Sample (adjusted): 1981 2010
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OILR)	0.043911	0.126875	0.346096	0.7320
C	0.097707	0.392472	0.248954	0.8053
U(-1)	-0.618827	0.176142	-3.513220	0.0016

R-squared	0.319559	Mean dependent var	0.083646
Adjusted R-squared	0.269156	S.D. dependent var	2.496354
S.E. of regression	2.134117	Akaike info criterion	4.448623
Sum squared resid	122.9704	Schwarz criterion	4.588743
Log likelihood	-63.72934	Hannan-Quinn criter.	4.493448
F-statistic	6.340087	Durbin-Watson stat	1.893510
Prob(F-statistic)	0.005529		

Appendix 4 : *BREUSCH-PAGAN,GOD FREY Test*

Heteroskedasticity Test: Breusch-Pagan-Godfrey

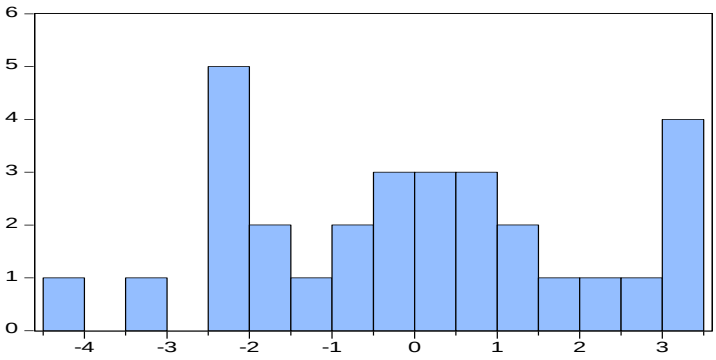
F-statistic	0.357588	Prob. F(2,27)	0.7026
Obs*R-squared	0.774135	Prob. Chi-Square(2)	0.6790
Scaled explained SS	0.375668	Prob. Chi-Square(2)	0.8288

Appendix 5 : *BREUSCH- GOD FREY LM Test*

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.168693	Prob. F(2,25)	0.8457
Obs*R-squared	0.399473	Prob. Chi-Square(2)	0.8189

Appendix 6 : *JARQUE BERA Normality Test*



Series: Residuals	
Sample 1981 2010	
Observations 30	
Mean	-7.59e-17
Median	-0.003964
Maximum	3.447523
Minimum	-4.216316
Std. Dev.	2.059213
Skewness	0.033931
Kurtosis	2.198208
Jarque-Bera	0.809344
Probability	0.667196

Appendix 7 : *The estimation of longrun equation by using Least Squares Method betwwen GDP and GAS*

Dependent Variable: GDP
Method: Least Squares
Date: 02/19/13 Time: 10:32
Sample: 1980 2010
Included observations: 31

Variable	Coefficient	Std. Error	t-Statistic	Prob.
GASR	0.140962	0.077973	1.807821	0.0810
C	1.385549	0.832552	1.664220	0.1068

R-squared	0.101283	Mean dependent var	2.693245
Adjusted R-squared	0.070293	S.D. dependent var	2.380157
S.E. of regression	2.294979	Akaike info criterion	4.561665
Sum squared resid	152.7409	Schwarz criterion	4.654181
Log likelihood	-68.70581	Hannan-Quinn criter.	4.591823
F-statistic	3.268218	Durbin-Watson stat	1.233860
Prob(F-statistic)	0.081017		

Appendix 8 : *Unit root test of residuals*

Null Hypothesis: U has a unit root
Exogenous: Constant
Bandwidth: 1 (Newey-West using Bartlett kernel)

	Adj. t-Stat	Prob.*
Phillips-Perron test statistic	-3.609078	0.0116

Test critical values:	1% level	-3.670170
	5% level	-2.963972
	10% level	-2.621007

*MacKinnon (1996) one-sided p-values.

Level of Significance	T Statistic	Critical Value
5%	-3.609078	-3.33

Appendix 9 : *Error Correction Model*

Dependent Variable: D(GDP)
Method: Least Squares
Date: 02/19/13 Time: 10:34
Sample (adjusted): 1981 2010
Included observations: 30 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(GASR)	0.070504	0.126111	0.559062	0.5807
C	0.056241	0.398540	0.141119	0.8888
U(-1)	-0.599781	0.180690	-3.319387	0.0026

R-squared	0.290137	Mean dependent var	0.083646
Adjusted R-squared	0.237555	S.D. dependent var	2.496354
S.E. of regression	2.179769	Akaike info criterion	4.490954
Sum squared resid	128.2876	Schwarz criterion	4.631074
Log likelihood	-64.36431	Hannan-Quinn criter.	4.535780
F-statistic	5.517758	Durbin-Watson stat	1.856179
Prob(F-statistic)	0.009792		

Appendix 10 : *BREUSCH-PAGAN, GODFREY Test*

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.552019	Prob. F(2,27)	0.5821
Obs*R-squared	1.178519	Prob. Chi-Square(2)	0.5547
Scaled explained SS	0.563582	Prob. Chi-Square(2)	0.7544

Appendix 11 : *BREUSCH- GOD FREY LM Test*

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.299443	Prob. F(2,25)	0.7439
Obs*R-squared	0.701849	Prob. Chi-Square(2)	0.7040

Appendix 12 : *JARQUE BERA Normality Test*